

DEVELOPMENTAL ASSESSMENT IN ARGENTINA:  
A COMPARISON OF TWO SCREENING INSTRUMENTS

by

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**Purpose:** Developmental screening is necessary to ensure that children are reaching appropriate developmental milestones at each age. According to the American Academy of Pediatrics (AAP), early identification of Developmental Disability (DD) is key to a child's well being. In Argentina, pediatricians are currently using the Prueba Nacional de Pesquisa (PRUNAPE), translated as The National Screening Tool, a pediatrician-administered screening tool that takes approximately 20 minutes to administer. Due to the high volume of patients seen by Argentine pediatricians, many do not have time to administer the PRUNAPE during a child's appointment, limiting the number of children screened for DD. Parent-completed screening tools, such as the Ages and Stages Questionnaire – Third Edition (ASQ-3), may be a good alternative for Argentine pediatricians. The reported success and efficiency of the Spanish translation of the ASQ-3 in other Spanish-speaking countries make it a strong candidate to be used as a developmental screening tool in Argentina.

**Method:** The PRUNAPE was compared to the ASQ-3 through two different methods. First, the two screeners were compared across research and development, test structure, and ease of administration. Second, a study comparing the results of the two screeners was conducted in a large hospital in Argentina. Pass/fail rates for each child on the ASQ-3 and the PRUNAPE were recorded and results were analyzed for each individual domain of each test and for the tests as a whole.

**Results:** The ASQ-3 requires significantly less administration and scoring time from a pediatrician and gathers more information across more domains of development than the PRUNAPE. Validation studies indicate that both tests are sensitive enough to identify children at-risk, but the ASQ-3 validation study was conducted on a much larger population. In the comparison study of the ASQ-3 and the PRUNAPE, there was no strong correlation between the pass/fail results of the two screeners, meaning that the two screeners did not identify the same children as at-risk for DD.

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## **Background**

### **Developmental Delays and Early Intervention**

The World Health Organization (WHO) reports that across the world approximately 5% of children, birth-14 years of age, have a moderate or severe disability (WHO, 2004). Young children with developmental delays constitute one part of this 5%. Developmental delay (DD) is defined by the American Academy of Pediatrics (AAP) as “the condition in which a child is not developing and/or achieving skills according to the expected time frame” (AAP, 2006, p. 406). Developmental delays that go undetected and untreated during early childhood can lead to behavioral and social problems, as well as academic failure later in life (AAP, 2006). For this reason, it is important that pediatricians screen young children for DD throughout early childhood so they can then be referred for further evaluation and receive early intervention if needed.

### **Importance of Standardized Developmental Screening**

The AAP defines developmental screening as a standardized tool that helps identify children who are at risk of DD (AAP, 2006). Developmental screening is necessary to ensure that children are reaching appropriate developmental milestones at each age. Pediatricians typically screen a child’s fine and gross motor, communication, personal-social, and cognitive skills in order to identify domains in which that child may be delayed in his/her development in comparison to other children his/her age. Fine motor development depends on the coordination of small muscle movements (often using the hand and fingers) and includes skills such as using scissors, picking up small items, and drawing. Gross motor development involves large muscle movement,

such as jumping and running. Communication development includes skills in both expressive and receptive language and speech sound production. Personal-social development pertains to how a child interacts with the environment around him or her, including skills in personal awareness and how a child engages with others. In young children, cognitive development is demonstrated through problem solving skills, including a child's ability to find a hidden toy or solve a puzzle.

Developmental screening can be conducted in multiple settings (such as a doctor's office or a preschool) by numerous different professionals (such as pediatricians, teachers, or social workers). When children are found to be at-risk, following developmental screening, they can be referred for further evaluation by qualified personnel, such as speech language pathologists (SLPs), physical therapists (PTs), early childhood educators (ECEs), or occupational therapists (OTs). Further testing can identify the presence/absence of a delay or disorder and if necessary the child can receive early treatment. According to the AAP, early identification of DD is key to a child's well being. The AAP has identified well-check appointments as the ideal time for children to be screened for DD. For this reason, the AAP established a policy in 2006 requiring pediatricians in the United States to administer screening tests at each child's 9-, 18- and 30-month doctor's appointments. Using this schedule for checkups, the AAP believes DDs will be identified earlier leading to "further developmental, and medical evaluation, diagnosis, and treatment, including early developmental intervention" (AAP, 2006, p. 405).

Developmental screening can be accomplished through the use of a commercially developed screening instrument or through developmental surveillance.



Commercially developed screening instruments can be administered to children directly by qualified personnel (e.g., during a doctor's visit) or can be completed by parents (e.g., prior to a doctor's visit).

**Developmental surveillance.** Many pediatricians rely on their expert opinion to screen their young patients' development. This technique is called developmental surveillance and is defined as "a flexible, continuous process whereby knowledgeable professionals perform skilled observations of children during the provision of health care" (Dworkin, 1993, p. 121). Developmental surveillance requires a pediatrician to hear parental concerns, gather relevant information about the child's developmental history, observe the child, and share any concerns with other professionals. Surveillance relies heavily on a pediatrician's training across developmental domains. During developmental surveillance, pediatricians can also use a checklist of developmental milestones while observing the child and speaking with the parents, to see which of the milestones the child has reached. However, these lists typically do not contain enough details specific to a child's age, which may cause pediatricians to miss a child who is at risk for DD (Glascoe, 1993). Research has found that the use of developmental surveillance alone leads to a low detection rate, missing up to 45 percent of children who might benefit from early intervention (Aylward, 2009).

**Commercially-developed screeners.** Formal screenings using commercially developed instruments more accurately identify children at-risk for DD (Rydz, et al., 2005). Commercially available screening instruments provide pediatricians with a standardized instrument in which to judge development. These screeners provide pediatricians with a clear way to record and evaluate each child's skills. It is important

that commercially-developed screeners accurately identify children at-risk. The validity of screening instruments can be measured by their sensitivity and specificity rates. Sensitivity is the proportion of children who are identified by the developmental screener as at-risk for DD, who are then further evaluated and diagnosed with DD. Specificity is the proportion of children who are identified by the developmental screener as not being at-risk for DD, who are further assessed and found to be typically developing. Developmental screening instruments should have sensitivity and specificity rates above 70% (AAP 2006).

***Pediatrician-administered screeners.*** Pediatrician-administered screening instruments are done during a child's well-check appointment. A pediatrician must be trained in the administration of the screening tool and have enough time during a child's appointment to administer, score, and evaluate the screener in order to determine if a child is at risk for DD. Pediatrician-administered instruments should have specific guidelines for the administration of the test in order to ensure the reliability of the instrument.

***Parental questionnaires.*** According to a recent study, parent-completed questionnaires were found to be as accurate as pediatrician-administered screening tools because parents "can give accurate information about their child's development" (Rydz, et al., 2006, p. 1179). Parental questionnaires not only save pediatricians' time, but can also give a pediatrician additional information provided through parent observations. Furthermore, this study demonstrated that majority of parents are willing to complete questionnaires (81% for the ASQ-3) (Rydz, et al., 2006).

The Ages and Stages Questionnaire- Third Edition (ASQ-3) is a frequently used parent-completed developmental screener. Parents fill out the screener and then pediatricians (or affiliated staff) score it. This questionnaire was developed at the University of Oregon and is now used both nationally and internationally. It is one of the developmental screeners approved by the AAP to monitor a child's developmental progress in place of a pediatrician-administered developmental screening tool (AAP, 2006). The ASQ-3 has been translated and adapted into a Spanish version that is now widely used across the United States, as well as in several other predominately Spanish-speaking countries.

### **Developmental Screening in Argentina**

The prevalence of DD in Argentina has not been reported, but the Argentine Society of Pediatrics (SAP) strongly recommends developmental screening (Salamanco, D'Anna, & Lejarraga, 2004). In Argentina, screening for DD is typically done during an appointment with a pediatrician or doctor. The healthcare system plays an important role in monitoring child development. The healthcare system is broken up into private and public institutions. Within these two sectors, Argentineans can choose to have their usual check-up appointments at free public health centers or free public hospitals. Citizens who go to private hospitals and health care centers pay using private insurance or "obras sociales", an insurance that can be bought through different trade union organizations. In the Ciudad Autonoma de Buenos Aires (CABA), which includes the city of Buenos Aires and its suburbs, approximately 18% of checkups for children under the age of 4 are done at public institutions, while 80% are done at private clinics or hospitals (Ministerio de Desarrollo Social de la Nación & UNICEF, 2013).

The Argentine Society of Pediatrics recommends that a developmental screening tool be administered to children during check-ups twice before a child reaches the age of 5 in order to catch signs of early DD. La Prueba Nacional de Pesquisa (PRUNAPE), translated as The National Screening Tool, is a pediatrician-administered screening tool that is designed to be administered during a child's well-check appointment (Lejarraga, Kelmansky, Pascucci, & Salamanco, 2005). This is the only screening tool that has been tested and validated for use in Argentina.

In a study done by UNICEF, roughly 86.7% of children under age 4 had attended an appointment with their pediatrician within the previous 6 months before filling out the questionnaire for UNICEF (Ministerio de Desarrollo Social de la Nación & UNICEF, 2013). This indicates that children are routinely being seen for well-check visits in Argentina. However, according to data collected by The World Bank, there are approximately 3.2 doctors per 1000 people in Argentina (World Bank, 2010). Given the high number of patients each pediatrician is assigned within this healthcare system, pediatricians must conduct brief consults with patients and often do not have 20 minutes to devote to administering the PRUNAPE. While there is no reported data on the use of the PRUNAPE in Argentina, according to Celina Lejarraga, a pediatrician involved in the development of the Cuestionario PRUNAPE Pre-Pesquisa (mentioned below), the PRUNAPE is being used in hospitals including the Hospital de Pediatría SAMIC Dr. Juan P Garrahan, Hospital Durand, Hospital Santojanni, Hospital de Niños Ricardo Gutierrez, and Hospital Italiano (C. Lejarraga, personal communication, April 24, 2014). According to one of the pediatricians on the research team for this study, doctors who do not use the PRUNAPE are relying solely on developmental surveillance during

appointments to monitor a child's development. (T. Moro, personal communication, July 29, 2013).

**CPPP.** Horacio Lejarraga, the author of the PRUNAPE, and other Argentine pediatricians have recognized that the training time and time required to administer the PRUNAPE may prove difficult for pediatricians working in programs that provide care for a large number of children (Lejarraga, et al., 2013). In December 2013, Lejarraga released a pre-screener, the Cuestionario PRUNAPE Pre-Pesquisa (CPPP), which was designed to be completed by parents and scored by their child's pediatrician prior to the child's visit. If the child fails the CPPP, then the doctor administers the PRUNAPE during the visit.

### **Research Questions**

Given the importance of developmental screening, a solution must be created to ensure that Argentine children are screened when they are young without taking up too much of the busy pediatrician's time. The aim of this study was to compare the ASQ-3 to the PRUNAPE/CPPP in order to answer the following two research questions.

1. How does PRUNAPE/CPPP compare to the ASQ-3 in terms of research and development, general structure (number of questions and type of questions), and ease of administration?
2. How does the ASQ-3 compare to the PRUNAPE when implemented as a screening tool in a large city in Argentina? What is relation between:
  - a. the overall pass/no pass rates of the two screeners?
  - b. the pass/no pass results for the individual domains of each screener?

## **Research Methodology**

### **Research Question 1: Systematic Review**

Information was collected about the three screening tools being compared in this study: the PRUNAPE, the Spanish translation of the ASQ-3, and the CPPP. When available, information was collected from screening tool manuals, as well as validity and reliability studies published in peer-reviewed journals. Table 1 lists all the materials used to answer the first research question.

**Research and development.** Each screener was evaluated across three different aspects of research and development; (a) sample population size; (b) sensitivity; (c) specificity. Information was found using the original research articles published about the PRUNAPE and the CPPP and the official screening manual of the ASQ-3.

Since the validity study for the ASQ-3 was done for the English version, validity studies of the Spanish translation of the ASQ-3 were also used for comparison. Three studies done in Spain, Chile, and the United States were examined. Conclusions of these studies were used to determine the accuracy of the Spanish translation of the ASQ-3.

**Structure.** The test protocols were examined for structure. The total numbers of items on each on each test as a whole, as well as the number of items per domain, were calculated. The types of items and questions that were asked on each screening tool were examined, comparing the detail and phrasing of each item or question. The individual questions on each screener were also examined to compare the questions that were asked on one instrument but not on the other, or if the questions appeared in one domain on one test, but in a different domain on another test.

**Administration.** In order to determine which screening instrument takes less time to administer and score, a comparison of the reported administration and scoring time for each screening tool was done using data reported in the ASQ-3, CPPP and PRUNAPE validation studies and screening manuals.

Table 1

*Materials used to answer research question 1*

Screening Tool	Citations of Materials Referenced
ASQ-3 (Ages and Stages Questionnaire – 3 <sup>rd</sup> Edition)	<p>Guiberson, M., &amp; Rodríguez, B. L. (2010). Measurement properties and classification accuracy of two Spanish parent surveys of language development for preschool-age children. <i>American Journal Of Speech-Language Pathology</i>, 19(3), 225-237.</p> <p>Pomá, M. (2012). <i>Examination of the Spanish translation of a developmental screening instrument</i>. (Unpublished doctoral dissertation). University of Oregon, Eugene, OR.</p> <p>Sarmiento, J. A., Squires, J., &amp; Ponte, J. (2010). Universal developmental screening: preliminary studies in Galicia, Spain. <i>Early Childhood Development and Care</i>, 1, 1-11. doi:10.1080/03004430903458007</p> <p>Schonhaut, L., Salinas, P., Armijo, I., Schönstedt, M., Álvarez, I., &amp; Manríquez, M. (2009). Validación de un cuestionario autoadministrado para la evaluación del desarrollo psicomotor. (<i>Validation of a self administered questionnaire for the evaluation of psychomotor development.</i>) <i>Revista Chilena de Pediatría</i>, 80(6), 513-519</p> <p>Squires, J., Bricker, D., Twombly, E., &amp; Potter, L. (2009). <i>ASQ-3 User's Guide</i>. Baltimore: Paul H. Brookes Publishing Co.</p>
PRUNAPE (Prueba Nacional de Pesquisa)	<p>Lejarraga, H., Kelmansky, D., Pascucci, M., &amp; Salamanco, G. (2005). <i>Prueba nacional de pesquisa: PRUNAPE manual técnico</i>. Buenos Aires, Argentina: Fundación Hospital de Pediatría "Prof. Dr. Juan P. Garrahan".</p> <p>Lejarraga, H., Menendez, A., Menzano, E., Guerra, L., Blancato, S., Planelli, P., ...Larigolita, D. (2008). PRUNAPE: investigation of psychomotor development disorders in primary care. <i>Archivos Argentinos de Pediatría</i>, 106(2), 119-125.</p> <p>Pascucci, MC et al. (2002). Validación de la Prueba Nacional de Pesquisa PRUNAPE. <i>Archivos Argentinos de Pediatría</i>, 100(3), 374-385.</p> <p>Salamanco, G., D'Anna, C., Lejarraga, H. (2004). Tiempo requerido para la administración de una prueba de pesquisa de trastornos del desarrollo psicomotor infantil. <i>Archivos Argentinos de Pediatría</i>, 102(3), 165-169.</p>
CPPP (cuestionario PRUNAPE pre-pesquisa)	<p>Lejarraga, H., Kelmansky, D., Lejarraga, C., Charrús, G., Salamanco, G., Inoja, I. &amp; Nunes, F. (2013). Validation of a questionnaire for the detection of children at high risk of developmental disorders. The PRUNAPE pre-screening test. <i>Archivos Argentinos de Pediatría</i>, 111(6), 476-483.</p>

## **Research Question 2**

Data for this part of the study was collected at a large private hospital in Buenos Aires, Argentina over a period of nine months. Researchers carried out a comparison study of the PRUNAPE and the Spanish translation of the ASQ-3 by administering both screeners to patients recruited in the pediatric section of the hospital. The CPPP was not developed and released at the time of this study so it was not included in the comparison of screeners. The student researcher participated in the data collection for the first two months. The research pediatricians continued the study for the remaining 7 months and emailed the data to the student researcher. Although it was requested, some of the data requested by the student researcher was not received (see below).

### **Participants.**

Fifty-four parents and guardians of children birth to 42-months of age were recruited to participate in this study. Parent and child demographics are reported in table 2. Before any testing occurred, research staff described the study, reviewed inclusion criteria, and obtained informed consent from parents. Parents, who agreed to participate, were included if they had children within the age requirement (birth to 42-months) and had the time to complete the screening tests. Parents were excluded if their children had an illness or a previous diagnosis of DD/ known developmental condition including:

- Low birth weight (Intrauterine Growth Restriction or preterm infants)
- Fetal exposure to toxins (infections, alcohol, drugs)
- Birth asphyxia
- Delay of growth in the first or second year of life
- Central Nervous System infections
- Malnutrition



- Sensory (vision, audition, tactile, olfactory, taste, proprioception, vestibular system) deficit
- Risk established or child has already been diagnosed with disease that affects development
- Genetic syndromes, preterm neonates, metabolic diseases, prenatal infections

During the first two months of the study, parents were recruited in one of the following ways: 1) 15 parents were recruited in the waiting room while waiting for their well-check appointments at the hospital, 2) 6 parents were recruited by their pediatricians during their well-checks, 3) 15 parents were recruited by a pediatrician in a specialty clinic for children at-risk. No data was reported for the remainder of the study.

Parents who were recruited in the waiting room were approached by the research team and asked the age of their child and if their child was born prematurely/had a known DD. If the child met the study qualifications, researchers then described the study and asked the parents to participate. Parents who agreed were then brought to a private clinic room for the administration of the ASQ-3 and the PRUNAPE.

When recruiting participants during appointments, the pediatrician, either an active participant of the research team or a member of the hospital staff, would describe the study and ask parents if they would like to participate. If the pediatrician was a part of the research staff, they would then administer the PRUNAPE during the child's appointment and afterwards send the parents to another room with the student researcher to complete the ASQ-3. Pediatricians who were not a part of the research team were made aware of the study and the participation requirements. They would identify potential participants during appointments and if the parents agreed to

participate, the pediatrician would send them to a room where a pediatrician on the research staff would administer the PRUNAPE and then parents would either fill out the ASQ-3 immediately or take it home to complete.

The head pediatrician of this study also held appointments for children who had been previously identified by other pediatricians or preschool teachers as having the potential for DD. For simplicity, these appointments will be referred to as appointments in the specialty clinic. The head pediatrician administered the PRUNAPE during the specialty clinic appointment and then if the parents agreed to participate in the study, they either went to another room with the student researcher to fill out the ASQ-3 immediately or took it home to complete.

Table 2

*Demographic information*

	Participants
<u>Child's Gender</u>	
Male	33
Female	21
<u>Child's age (m age = 16 mo.)</u>	
1 – 2 mo. 30 days	2
3 – 4 mo. 30 days	2
5 – 6 mo. 30 days	5
7 – 8 mo. 30 days	3
9 – 9 mo. 30 days	4
10 – 10 mo. 30 days	1
11 – 12 mo. 30 days	6
13 – 14 mo. 30 days	1
15 – 16 mo. 30 days	4
17 – 18 mo. 30 days	1
19 – 20 mo. 30 days	1
21 – 22 mo. 30 days	4
23 – 25 mo. 15 days	4
25 mo. 16 days – 28 mo. 15 days	1
28 mo. 16 days – 31 mo. 15 days	5
31 mo. 16 days – 34 mo. 15 days	2
34 mo. 16 days – 38 mo. 15 days	1
39 – 44 mo. 30 days	1
<u>Family Health Insurance</u>	
Plan de Salud	28
AMPER	4
Poder Judicial	4
Private	17
Not Reported	1
<u>Parent Education</u>	
Post-secondary	29
Incomplete Univ. Education	3
High School	12
Junior High	2
Not Reported	8

***Research staff.***

The research staff consisted of five pediatricians (four female and one male) and one student researcher. All research pediatricians worked for the hospital and were trained in the administration of the PRUNAPE. The number of screenings administered for this study by each pediatrician during the first two months is reported below in Table 3. The number of screenings administered for this study by each pediatrician for the remainder of the study was not reported.

Table 3

***Number of screenings administered by pediatricians***

Pediatrician	Number of screenings administered
1 (Head Pediatrician)	15
2	12
3	5
4	3
5	2

**Study procedures.** During the first two months, 30 parents/guardians completed the ASQ-3 at the hospital and were provided access to a kit full of any materials necessary to answer the questions on the ASQ-3. The research staff was present to help parents with questions or concerns they had while filling out the questionnaire. Four parent/guardians decided to take it home to complete. Two of the parents brought the filled out form back to one of the hospital locations where a member of the research staff worked. One was called by the student researcher two weeks later and asked to verbally relay her answers for each domain of the ASQ-3. One questionnaire was never returned. The procedures for parents were not reported for the remainder of the study.

The ASQ-3 and the PRUNAPE were both scored according to the publisher's directions and data were recorded for the screening instruments as a whole (pass/no pass) and also by domain (pass/no pass per developmental domain). For the screener as a whole, a "pass" meant that the child had passed all domains of the screener and therefore no additional testing was recommended. A "no pass" meant that the child had not passed one or more domains of the screener and additional testing was recommended. Domain analysis varied since the ASQ-3 and the PRUNAPE have different domains and are scored differently. For the PRUNAPE, the number of failed A tasks and B tasks was recorded for each domain. For the ASQ-3, each domain was marked 0 (white/pass), 1 (black/fail), and 2 (gray/pass but needs close surveillance).

**Data analysis.** Cohen's Kappa was used to determine if the agreement between the two screeners was greater than that expected by chance. Cohen's Kappa is presented by the following function:

$$\kappa = \frac{\text{Pr}(a) - \text{Pr}(e)}{1 - \text{Pr}(e)},$$

where  $\kappa$  represents the total concordance between the two tests,  $\text{Pr}(a)$  is the total number of participants who had the same results from both screeners (ie., either passed or failed both tests).  $\text{Pr}(e)$  is found by adding the number of passes and no passes for each separate test and dividing that number by the total number of participants and then adding these two numbers together. An online computer software program was used (Graph Pad, available at <http://graphpad.com/quickcalcs/kappa1.cfm>) to calculate Cohen's Kappa in order to reduce the chance of human error. A kappa of .6 - .8 is considered moderate, and an agreement above .8 is considered almost perfect agreement.

and therefore acceptable for a screening tool (Landis, & Koch, 1977) A .8 means that 80% of the agreement between the two items being compared is not due to chance and therefore is determined to be a strong agreement.

## **Results**

### **Research Question 1**

This section covers the data that was collected in the comparison of the research and development, administration, and structure of the PRUNAPE, ASQ-3, and CPPP.

#### **Research and development.**

**PRUNAPE.** The PRUNAPE was created based on a population of 329 healthy children who were evaluated in preschools and doctors' offices in Argentina. The results from developmental evaluations of these children were used to determine the criteria for the cutoff point of the A and B milestones. The PRUNAPE has a format similar the pediatrician-administered Denver screening (Lejarraga, Kelmansky, Pascucci, & Salamanco, 2005, p. 31). The PRUNAPE was then given to 106 children, ranging from 0 to 5.99 years of age. After administering the PRUNAPE to these children, the criteria for a pass or no-pass were determined by adjusting the children's scores in order to find the point at which there was the highest sensitivity and specificity rates. After comparing the sensitivity and specificity of the test using just milestone B cutoffs, just milestone A cutoffs, and a combination of the two, Lejarraga settled on using 1-A or 2-B milestones that a child was unable to complete as the final criteria for the failing of the PRUNAPE. The focus was on having a high specificity rate, to ensure that the least amount of children possible with DD were missed. According to these cutoff rates, approximately 20% of the test population failed the screening (Lejarraga et

al., 2008). This screener has a reported sensitivity of 80% and specificity of 93% (Lejarraga, et al., 2005, p. 44). These results are shown in Table 4.

*CPPP.* The CPPP was administered to a sample of 533 children (see Table 4) in Buenos Aires (Lejarraga, et al. 2013). It was administered in two ways; parents either directly filled it out (CPPP-SA) or were asked the questions by a psychologist, educational psychologist or pediatrician (CPPP-HP). The respective rates for the CPPP-SA and CPPP-HP showed a Cohen's Kappa coefficient of .23 and .28 when compared with the PRUNAPE, a sensitivity rate of 41-43%, and a specificity: 81-85% (Lejarraga, et al. 2013 p. 476).

*ASQ-3.* The ASQ-3 was originally validated using questionnaires received from a sample of 18,572 participants across the United States (see Table 4). Using this sample, researchers tested the ASQ-3 for test-retest reliability, interobserver reliability, internal consistency, and concurrent validity. From this study, researchers determined that a cutoff point of 2 standard deviations below the mean resulted in the highest specificity and sensitivity rates across all the questionnaires. Using these cutoff points, the ASQ-3 has a specificity of 85% and a sensitivity of 86% (Squires, Bricker, Twombly, & Potter, 2009, p. 172). Researchers also determined a "monitoring zone" for children which fell between 1 and 2 standard deviations from the mean (Squires, et al., 2009, p. 170).

The ASQ-3 has also been adapted, translated and tested in many other countries. In studies conducted in Norway, Finland, Quebec, Canada, South Africa, Korea, Turkey, India, Shanghai, Spain, the Netherlands, Brazil, Thailand, Chile, and Taiwan, the ASQ-3 has proved to have a high validity in each test population. The Spanish

translation of the ASQ-3 has been tested for accuracy in several Spanish-speaking populations, including Spanish-speaking families in the U.S. (Guiberson, & Rodriguez, 2010; Pomés, 2012), upper-middle class families in Santiago, Chile (Schonhaut, Salinas, Armijo, Schönstedt, Álvarez, & Manríquez, 2009), and preschoolers in Galicia, Spain (Sarmiento, Squires, & Ponte, 2010). In the studies done with Spanish speakers in the U.S., Spain and Chile, the results show that the Spanish translation of the ASQ-3 is an accurate screening tool when used in different Spanish-speaking populations.

Researchers, Sarmiento, Squires and Ponte, completed a study comparing results from the ASQ-3 used in the preschools in Galicia, Spain with those found in the United States and Norway. In a comparison of the sensitivity and specificity rates found in the study in Galicia and in the United States and Norway, the results showed that there was no difference between the two, meaning that the validity rates acquired for the screening tool when used in Galicia were just as high as when it was used in the U.S. From these results, the study determined that the Spanish translation of the ASQ-3 could be used as an effective and efficient screening tool in Galicia, Spain (Sarmiento, Squires, & Ponte, 2010).

Researchers in Chile conducted a study to determine if there was a strong correlation between the results from the ASQ-3 and the Bayley Scales of Infant Development (Bayley III) that was considered to be the gold standard of developmental testing, but a rather difficult tool to access in Chile. The study included a total of 306 children attending a well-child clinic in Santiago, Chile. Parents filled out the ASQ-3 and pediatricians administered the Bayley-III. With the participants in that study, the ASQ-3 had a sensitivity of 58.8% and a specificity of 87.2% and an overall agreement



of 56% with the Bayley Scales of Infant Development. Given the high specificity rate, and the time and cost limitations posed by the use of the Bayley-III, researchers concluded that the ASQ-3 be recommended for screening children at 8-, 18- and 30-months of corrected gestational ages (Schonhaut, et al., 2009).

The study done by Pomés on Spanish-speaking populations in the U.S. revealed that the majority of items on the Spanish-translation of the ASQ-3 could be understood and correctly evaluated by parents filling out the questionnaire (Pomés, 2012). Pomés found roughly approximately 30% of the questions asked on the Spanish translation of the ASQ-3, to function differently than on the English version of the ASQ-3, meaning that the question on the Spanish translation may not test the same skill that it tests on the English version. The study also showed 16 of the 180 items evaluated on the ASQ-3 to be misfit items, items that were misrepresented on the Spanish translation. When interviewing parents who participated in the study, the majority responded that the Spanish translation was clearly written and easy to respond to and understand.

Table 4

*Comparison of Ages and Stages Questionnaire – Third Edition (ASQ-3), Prueba Nacional de Pesquisa (PRUNAPE) and Cuestionario PRUNAPE Pre-Pesquisa – Self Administration/Health Professional (CPPP-SA/HP) in research and development.*

	PRUNAPE	ASQ-3	CPPP-SA/HP
Study Sample Population	106	18,572	533
Sensitivity	80%	86%	41%/42%
Specificity	93%	85%	81%/85%

### **Administration.**

***PRUNAPE.*** The PRUNAPE is administered by a pediatrician during a regularly scheduled appointment with the parent or caregiver present and takes approximately 20

minutes to administer and score. The pediatrician presents the child with certain developmental tasks and then observes the child to see if he or she can accomplish them. The pediatrician then scores the child's performance on each task and adds up the total tasks that the child passed and failed.

**CPPP.** The CPPP is completed before a child's well-check appointment by a parent or by another professional asking questions to a parent. Pediatricians score the questionnaire and then decide if they need to complete the PRUNAPE during the child's visit. If the child passes the CPPP, then the pediatrician doesn't need to do take the time to do the PRUNAPE. The time required to administer and score the CPPP was not reported.

**ASQ-3.** The ASQ-3 is filled out by parents and then scored by a pediatrician or someone else at the pediatrician's office. The time required to score the ASQ-3 is between 2-5 minutes. Parents can fill out the ASQ-3 while sitting in a waiting room or can take the questionnaire home and send or bring it back in at a later time.

Table 5

*Administration comparison across the Ages and Stages Questionnaire- Third Edition (ASQ-3), Prueba Nacional de Pesquisa (PRUNAPE) and Cuestionario PRUNAPE Pre-Pesquisa (CPPP).*

	ASQ-3	PRUNAPE	CPPP
Administration/ scoring time required by pediatricians	2-5 min	20 min	NR
Person administering/completing screening questionnaire	Parent/guardian	Pediatrician	Parent/guardian or healthcare professional

NR = Not Reported

## **Structure.**

**PRUNAPE.** The PRUNAPE measures 79 different developmental items that are grouped into four domains: personal-social, fine motor, language and gross motor (see Table 6). Each item is represented on the test by a bar that shows at which age 25%, 50%, 75% and 90% of children have mastered that item (See Appendix A). The end of the bar represents 25%, 50% is represented by a tick mark at the top of the bar, 75% is represented by the left side of the shaded (gray) area, and 90% is represented by the right end of the bar. A child is scored *pasa/pass* (P), *falla/fail* (F), or *rehúsa/no response or opportunity* (R) according to the instructions given in the PRUNAPE manual. A line is drawn vertically on the form according to the child's age. If the line crosses the bar in any zone to the left of 90%, this means that there is a percentage greater than 10% of normal children that can complete the item at older ages than the child being screened. An item in which the line passes to the right of the bar is called "Item A" and an item that crosses the bar between 75-90% is called "Item B". For each domain, the pediatrician tests each item where the line goes through the gray area of the bar, the "B Items", as well as the three "Item A" tasks that appear closest to the left of the line.

Most items must be demonstrated to the pediatrician during the child's appointment. However, there are certain tasks, indicated by a \* that can be marked according to answers given by parents. Items marked with the letter "M" are tasks that can be demonstrated by the pediatrician and items marked "2-4" are tasks that allow the child to make 2-4 additional attempts if they do not complete the task on the first try.

**CPPP.** As noted in Table 6, the CPPP consists of five different questionnaires (each specific to a certain age range) that include questions pertaining to 57 of the 79

milestones listed on the PRUNAPE. The CPPP asks 14-16 questions for each age range, with all questions asked in one group rather than divided into different developmental domains.

**ASQ-3.** The ASQ-3 is a parent-completed questionnaire covering five domains of development; fine motor, gross motor, language and communication, problem solving, and personal/social (see Table 6). There are 21 ASQ-3 questionnaires for children ages 1-month to 5.5 years, at each of the following different age intervals: 2-, 4-, 6-, 8-, 9-, 10-, 12-, 14-, 16-, 18-, 20-, 22-, 24-, 27-, 30-, 33-, 36-, 42-, 48-, 54-, and 60-months of age. A maximum of 10 points is assigned if a parent answers “sí/yes” to a question, 5 points is assigned for “a veces/sometimes” and 0 points is assigned if a parent answers “no”. The total score is then filled in on a chart correlating with either the black (fail), grey (pass but needs close surveillance), or white section (pass). If a child scores in the black on any section, the child is at risk for development delay in that domain and fails the ASQ-3.

Each ASQ-3 questionnaire asks a total of 30 questions, six per domain, for each age range (not including the general observation questions). The following is an example of the questions asked on the 2-month ASQ-3 questionnaire (see Appendix B) about a child’s fine motor skills (a child’s ability to grasp objects with his or her hands). “1) *Cuando está despierta, ¿su bebé usualmente tiene las manos cerradas? (Si antes las mantenía cerradas, pero ahora las abre, marque sí)* “When awake, does your baby usually have his/her hands closed” (If he/she kept them closed before, but opens them now, mark yes” 2) *Cuando Ud. toca con su dedo la palma de la mano de su bebé, ¿le agarra su dedo?* “When you touch your finger to the palm of your child’s hand, does

he/she grab your finger?” 3) *Cuando Ud. pone un juguete en la mano de su bebé, ¿lo sostiene por algunos instantes?* “When you put a toy in your child’s hand, does he/she hold onto it for several seconds?” 4) *Cuando está despierto, ¿su bebe mantiene las manos abiertas, al menos parcialmente (en vez de tenerlas en puño, como cuando era recién nacido).* “When awake, does your child keep his/her hands open, at least partially (instead of holding them in fists, like when he/she was a newborn)”.

Table 6

*Structural comparison of the ASQ-3 (Ages and Stages Questionnaire-3<sup>rd</sup> Edition), PRUNAPE (Prueba Nacional de Pesquisa) and CPPP (Cuestionario PRUNAPE Pre-Pesquisa).*

	ASQ-3	PRUNAPE	CPPP
Number of domains	5	4	1
Number of questions/items per domain	6	4	14-16
Number of questionnaires	21	1	5
Number of total tasks/questions asked per questionnaire	30	16	14-16
Number of questions that were not included on the other screener*	132	15	15

\*the number of questions that were asked on the PRUNAPE that were not included on the ASQ-3 and the number of questions that were asked on the ASQ-3 that were not included in the PRUNAPE.

## Research Question 2

The results corresponding to research question 2, comparing the PRUNAPE and ASQ-3 in an Argentine population, are laid out in this section, including: the agreement of the overall results (Cohen’s Kappa), the agreement of the results for each individual domain on the screeners, the pass/fail rates divided up according to the administering pediatrician, and the agreement of the overall results given different cutoff points.

**Overall Screener Agreement.** Pass/fail rates for the PRUNAPE and the ASQ-3 were analyzed. The two screeners yielded the same results approximately 76% of the time (41/54 agreement). As shown in Table 7, this resulted in a Cohen's Kappa of .47, which fell below the suggested .80 coefficient, indicating that there was not strong agreement between the two tests. Approximately 30 (55%) of the test results were determined to agree purely due to chance according to Cohen's Kappa.

Table 7

	ASQ-3 (Ages and Stages Questionnaire – 3 <sup>rd</sup> Edition) Pass	ASQ-3 Fail
PRUNAPE (Prueba Nacional de Pesquisa) pass	29	6
PRUNAPE fail	7	12
Total	36	18

*Pass/Fail Results - Cohen's Kappa*

K= 0.466

Number of observed agreements: 41 (75.93% of the observations)

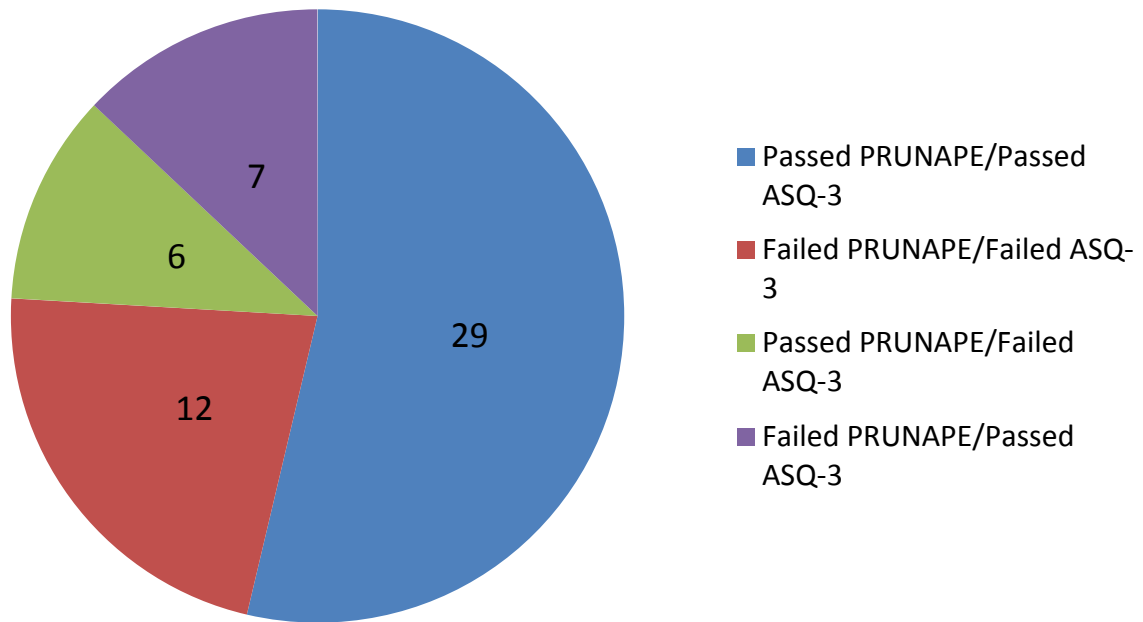
Number of agreements expected by chance: 29.7 (54.94% of the observations)

Further analysis of the results showed that of the participants who failed one

screener but passed the other, neither screener showed a strong tendency to either pass or fail more children. Of the 13 tests that didn't agree, six passed the PRUNAPE but failed the ASQ-3 and seven failed the PRUNAPE but passed the ASQ-3. Overall, 25/54 children failed either both or one of the screeners. This means that the failure rate for this study was 46%, just under half of the sample population. These results are shown in Figure 1.

Figure 1

*Overall Results*



While the agreement rate for the overall results was 76% and had a Cohen's Kappa of .47, the agreement of the results for the participants screened by each pediatrician varied, as shown in Table 8. The head pediatrician working in the specialty clinic who had the most experience using the PRUNAPE had the highest screener agreement with 13 of the 15 screener results agreeing.

Table 8

*Agreement results for each pediatrician*

	Agreement	Total	Percentage	Cohen's Kappa
Pediatrician 1	13	15	87%	.727
Pediatrician 2	7	11	63%	.241
Pediatrician 3	3	5	60%	.167
Pediatrician 4	2	3	67%	0
Pediatrician 5	0	2	0%	0

As shown in Table 9, of the 15 participants who were recruited in the specialty clinic appointments, half of the group failed the PRUNAPE or both screeners. Two failed the PRUNAPE but passed the ASQ-3, five failed both screeners and eight passed both screeners. Even though the specialty clinic was for children already suspected of having a DD, the failure rates through the specialty clinic were lower than those of as the failure rates through the hospital as a whole.

Table 9

*Pass/Fail results for each pediatrician*

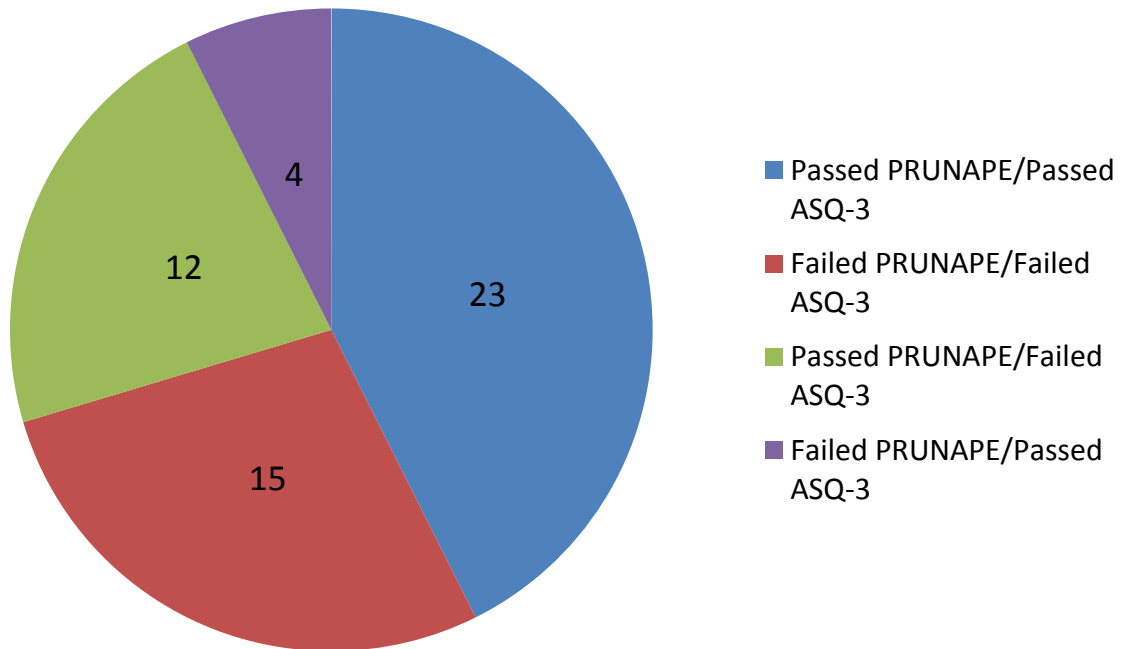
	Pass	% pass rate	Fail	% fail rate
Specialty Clinic (Pediatrician 1)	8	53%	7	47%
Pediatrician 2	5	45.5%	6	54.5%
Pediatrician 3	2	40%	3	60%
Pediatrician 4	2	67%	1	33%
Pediatrician 5	0	0%	2	100%
Overall	17	47%	19	53%

Due to such a low agreement between the results of the two screeners, the data were reexamined to determine if agreement improved when ASQ-3 cutoffs were changed. When the cutoff point determining if a child failed the ASQ-3 was changed to include children who scored in the grey area (need surveillance), there was no change in agreement. These results are displayed in Figure 2. Overall, failing participants who scored in the grey area on the ASQ-3 resulted in nine additional no pass ratings; three failed both screeners, and six failed the ASQ-3 but passed the PRUNAPE. This resulted in 38/54 agreement (70%) and a Cohen's Kappa of .41, which fell below the suggested .80 coefficient indicating that there was not strong agreement between the two tests. The number of children who failed the ASQ-3 but passed the PRUNAPE changed from six to 15 with the new cutoff scores.



Figure 2

*Pass/Fail rates when using gray area of ASQ-3 as cutoff criteria*



**Domain agreement.** An individual domain analysis was conducted to determine if the overall screener disagreement was due to disagreement between the two screeners in a specific test domain. Results of this analysis are displayed in Table 9. Two domains were identified as potential sources of disagreement. The PRUNAPE failed more children in the language domain Four children failed the PRUNAPE language domain, but passed the ASQ-3, while the ASQ-3 failed only one child in the language domain who passed the PRUNAPE language domain Further analysis found that there were four language developmental milestone questions that were asked on the PRUNAPE, that were not asked on the ASQ-3. Three of the four questions were asked for children above 11-months, and the other was for child 1-month old or younger. The

four children who failed the language domain of the PRUNAPE were all above 28-months in age, and therefore were asked these questions that were not included in the ASQ-3.

Data also showed that six children failed the ASQ-3 problem solving domain, but passed the PRUNAPE overall. The PRUNAPE does not have a problem solving domain. In a detailed analysis, it was found that only 8/ 44 ASQ-3 problem-solving questions (ages 0-42 months of age) were included in some other domain on the PRUNAPE. Five were included in the fine motor domain, one in the language domain and two in the personal/social domain. There were none included in the gross motor domain. When comparing the answers of the screeners of the six children who failed the problem solving domain of the ASQ-3 and also failed the PRUNAPE, there was not a specific domain in which the failures seemed to correlate. Three of the six children who failed the problem solving domain of the ASQ, also failed every other domain on the ASQ-3. The fourth child failed all the domains of the ASQ-3 excluding the gross motor domain, and the other two children failed just the problem solving domain and a combination of the problem solving and fine motor domains. Two of the children who failed all the domains of the ASQ-3, also failed a task in each domain of the PRUNAPE. The other children failed the PRUNAPE in various different domains.

Table 10

*Individual domain results (Numbers represent how many children failed a domain of one screener but passed the same domain of the other screener)*

	Prueba Nacional de Pesquisa (PRUNAPE)	Ages and Stages Questionnaire 3-rd Edition (ASQ-3)
Gross Motor	3	3
Fine Motor	5	3
Social	5	3
Language	4	1
Problem Solving	N/A*	6

\*the PRUNAPE has no problem solving domain

### Discussion

While both the ASQ-3 and the PRUNAPE have high reported sensitivity and specificity rates (Lejarraga, et al., 2005, p. 44; Squires, et al., 2009, p. 172) the ASQ-3 was validated using a much larger sample size, making it the stronger screener in terms of research and development. In addition, there have been numerous other studies done testing the validity of the English version of the ASQ-3 as well as multiple studies done supporting the ASQ-3 Spanish translation's validity in several different countries. The studies done in Spain and the United States both reported high specificity and sensitivity rates (Sarmiento, Squires, & Ponte, 2010; Pomés, 2012), however it is important to note the low sensitivity rate found in the ASQ-3 study done in Chile (Schonhaut, et al., 2009). The low sensitivity rate signifies that there were a large number of children who were identified by the ASQ-3 as being at risk for DD who were later evaluated as developing normally. Based on this study, the ASQ-3 seems to over-identify children within that population. While it can be costly and time consuming to

have a screening tool that over-identifies, the main focus of the screener is to ensure that children with DD are not missed in the screening process, therefore a low sensitivity rate is preferable to a low specificity rate.

The CPPP also demonstrates a low sensitivity rate. The CPPP has the same goal as the ASQ-3 of ensuring that no children with DDs are missed and not identified during the screening. However over-identification while using the CPPP means that the PRUNAPE must still be administered to a large portion of the children coming in for appointments.

The CPPP also has a low Cohen's Kappa when the pass and fail results are compared with the results of the PRUNAPE. While the CPPP was developed as a parental-questionnaire that would identify children needing a full screening using the PRUNAPE, the low Cohen's Kappa coefficient indicates that the CPPP does not identify the same children as the PRUNAPE and therefore may not be the best indicator of children who may be at risk and should be screened using the PRUNAPE. The low sensitivity combined with the low Cohen's Kappa of the CPPP means that the goal of the CPPP, to eliminate the number of PRUNAPE screenings that must be administered during a well-check appointment, may not be achieved with this pre-screener.

The reported administration and scoring time required by a pediatrician using the ASQ-3 is much less than that required of the PRUNAPE and therefore the ASQ-3 appears to be a better option for pediatricians who may not have time to administer a screening during an appointment. Because parents can fill out the form before the appointment, either at home or in the waiting room, the pediatrician is only required to score it (or oversee someone on staff who scores it) and then can spend the rest of the

appointment discussing the results of the screener with the parent and performing other necessary duties during the appointment.

The comparison study of the two screeners in a large Argentine hospital revealed a poor correlation between the results of the ASQ-3 and the PRUNAPE, even when the cutoff points were adjusted for the ASQ-3. The disagreement between the results of the two screeners does not come as a surprise once one analyzes the two screeners in more detail. While both screeners tested the same developmental milestones overall, the format of the two screeners differed significantly, potentially causing the difference in children identified. The ASQ-3 contains detailed questions covering more developmental domains. Tasks are simplified and separated out into behaviors that a parent can easily observe. The PRUNAPE uses milestones that a pediatrician can recognize and can then use to generalize a child's ability to perform similar developmental tasks. The tasks on the PRUNAPE must be quick and relatively easy to observe in a clinical setting. While the ASQ-3 contains more detailed skill-based questions, the PRUNAPE focuses on more conceptual milestones. This requires pediatricians to be knowledgeable about development and relies on their ability to translate observable skills into milestone acquisition.

On the CPPP, the grouping of the questions into consecutive questions rather than dividing them into separate developmental domains makes it more difficult for pediatricians to identify potential risk domains. The CPPP can identify if a child fails overall but does not specify which domains are problematic. If the CPPP was divided into separate developmental domains similar to the PRUNAPE, this may save pediatricians time when administering the PRUNAPE to children who failed the CPPP.

If running low on time during an appointment, the pediatrician could potentially just screen the domain that the child failed on the CPPP, rather than doing a full screening.

Overall, the PRUNAPE and ASQ-3 appeared to differ the most in the language domain. This may be due to a difference in the questions asked in these domains for children at older ages. The questions included on the PRUNAPE that did not appear on the ASQ-3 tended to be the questions that the children failed. This discrepancy between the two screeners may have been one of the factors that contributed towards the tendency for older children to fail the language domain of the PRUNAPE but pass the same domain of the ASQ-3.

Another reason for the disagreement between the different domains of the screener comes from the problem solving domain of the ASQ-3, which does not appear on the PRUNAPE. Children who failed this portion of the ASQ-3 therefore could not fail the same domain of the PRUNAPE because the questions for this domain were either not asked on the PRUNAPE or were included in other domains of the PRUNAPE, causing the child to fail a different domain on the PRUNAPE.

It is important to consider the impact that having different pediatricians administer the PRUNAPE can have on the reliability of the screening tool. While there are specific guidelines for the administration and scoring of each item on the PRUNAPE provided during the training and in the PRUNAPE manual, this does not completely eliminate the subjectivity of the screening that comes from each individual pediatrician. Several factors, such as the time since the pediatrician took the PRUNAPE training course, the number of PRUNAPE screenings a pediatrician administers a week, and their level of confidence in the administration of the

PRUNAPE, have the potential to affect the results of the screening. The head pediatrician of the research team had the most experience administering the PRUNAPE out of the research team members. Given his greater familiarity with the screening instrument, it is important to note that the agreement between the two screeners in his specialty clinic, a Cohen's Kappa of .727, was significantly higher than the Cohen's Kappa found using the overall results in the study. His experience in administering the PRUNAPE may have contributed to this higher agreement.

The 46% failure rate found in this study is quite a bit higher than the average 5% of children the World Health Organization reported as having a moderate or severe disability (WHO, 2004). While this high failure rate does not directly affect the comparison of the two screening tests, it is an important piece of information to note. When looking at individual test results, it was not evident that one test failed more children than the other. Of the results that disagreed, six children failed the ASQ-3 and seven failed the PRUNAPE. Therefore a higher tendency to fail children in one test over the other was ruled out as a possible cause for this high failure rate.

The failure rate for children seen in the specialty clinic screened during the first two months of the study is equivalent to that of children recruited at well-visits and in the waiting room. The 46% failure rate of the specialty clinic is, in fact, below the 50% failure rate of the participants recruited during the first two months, and equal to the 46% failure rate of the overall study. Given this data, the use of the specialty clinic to recruit participants cannot be considered a main cause of the high failure rate found in this study.

### **Implications for Pediatricians in Argentina**

Screening for DD should be high priority for professionals working with young children. It is important that a formal screening tool is used to identify children who are at risk for DD because research indicates that professional surveillance alone can miss detecting almost half of children with DD (Aylward, 2009). Unless an alternative is created giving pediatricians more time with patients during an appointment, pediatricians should consider the use of parent-completed questionnaires. The CPPP was a solution to this problem, however, given the low sensitivity rate of CPPP, pediatricians would still have to administer the PRUNAPE to a large number of children.

Based on the comparisons between the ASQ-3 and the PRUNAPE in this study, the two screeners do not identify the same children as at-risk. The ASQ-3 has been tested in larger sample populations, has evidence of strong validity in various Spanish speaking populations, and is a more detailed screening tool. Therefore, while the results of the ASQ-3 do not agree with those of the PRUNAPE in this study, the ASQ-3 should still be considered for use by Argentine pediatricians and professionals working with young children. Continued research to determine the sensitivity and specificity rates of the ASQ-3 within the Argentine population is recommended.

### **Implications for Early Childhood Care Providers**

Another option for developmental screening lies in the preschool and daycare providers. Preschools and early childhood care centers can be helpful in assessing and identifying children who may be at risk for DD. According to a study done by UNICEF, roughly 20% of children under the age of 2 attend some sort of preschool or childcare



facility. The number grows to 50% at age 3 and then 76% at age 4. Specifically in the region of the Ciudad Autonoma de Buenos Aires (CABA), 61% of children attend some sort of preschool (Ministerio de Desarrollo Social de la Nación, & UNICEF, 2013). The childcare and preschool programs in Argentina consist of; sectors of either the public or private educational systems, as a part of the municipal and state programs, or as private programs supported by communities and foundations. The UNICEF study reports that 57% of children attend public preschool, while 42% attend a private daycare (Ministerio de Desarrollo Social de la Nación, & UNICEF, 2013).

The use of the ASQ-3 and parental developmental questionnaires should be considered in preschools due to the high number of children attending preschools by the age of 4. Between developmental screening in well-check appointments and with children being screened at preschools, there is less of a chance of children being missed in the early identification of DD.

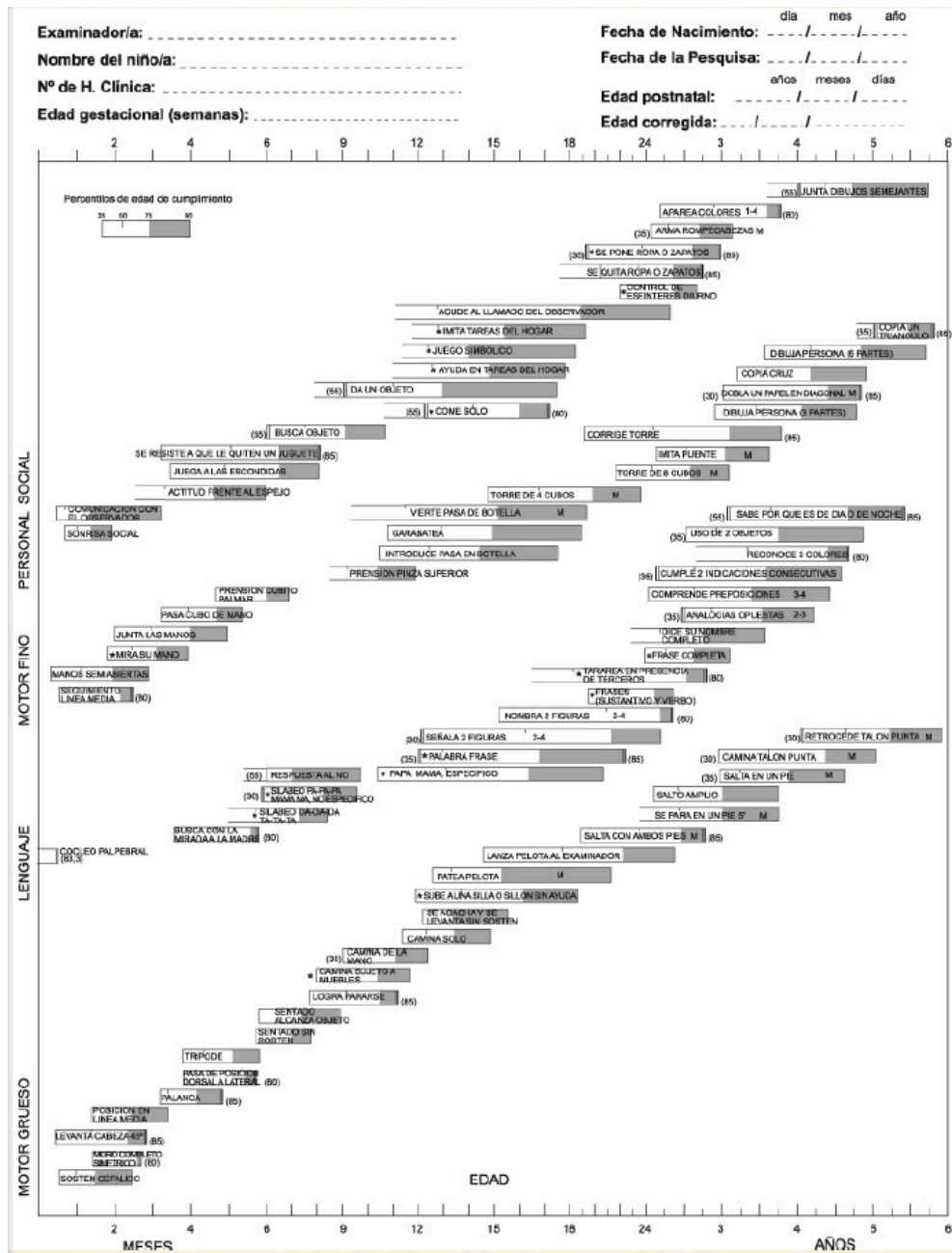
### **Future Directions**

There still remains a critical need for a time-sensitive, cost-effective, valid and reliable screening tool to be used in Argentina. This study compared the PRUNAPE and Spanish translation of the ASQ-3 to determine if the two screeners identified the same children as at risk for DD. Given that the results disagreed, further work must be done in comparing these two instruments to determine which screening tool is better at correctly identifying children who are developing normally, and those who are at risk for DD. Due to the small sample size used in this study, it is important to consider that the results may have been different given a larger sample population. While the trend seems to lead towards a high disagreement between the two screeners, different

conclusions may be reached with a larger sample size. Given the different agreement results for each pediatrician in this study, further research should be done to examine the pass/fail rates of the participants in relation to the pediatricians, based on their training and amount of experience administering the PRUNAPE.

Pediatricians and researchers must work together to either create or find a screening tool that has a high specificity and sensitivity rate for the Argentine population and is fast and efficient to administer/score. One path to this screening tool could be a continuation of this study. Using a larger sample size, future research using the ASQ-3 could include a continuation and follow-up with each of the participants after they have been developmentally evaluated. Using the results of these evaluations, a sensitivity and specificity rate could be calculated for both the ASQ-3 and PRUNAPE to determine which screener is the better tool to identify children who are at risk for DD.

## Prueba Nacional de Pesquisa (PRUNAPE)



## Appendix B

### Ages and Stages Questionnaire-3<sup>rd</sup> Edition (ASQ-3) 2-month questionnaire



Cuestionario de 2 meses página 3 de 5

#### MOTORA FINA

	SI	A VECES	TODAVIA NO	
1. Cuando está despierta, ¿su bebé usualmente tiene las manos cerradas? (Si antes las mantenía cerradas, pero ahora las abre, marque "sí".)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	—
2. Cuando Ud. toca con su dedo la palma de la mano de su bebé, ¿le agarra el dedo?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	—
3. Cuando Ud. pone un juguete en la mano de su bebé, ¿lo sostiene por algunos instantes?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	—
4. ¿Su bebé toca su propia cara con sus manos?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	—
5. Cuando está despierto, ¿su bebé mantiene las manos abiertas, al menos parcialmente (en vez de tenerlas cerradas en puño, como cuando era recién nacido)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	— *
6. ¿Su bebé intenta agarrar o jalar su propia ropa?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	—

TOTAL EN MOTORA FINA

\*Si marcó "sí" en la pregunta 5, marque "sí" en la pregunta 1 también.

## IRB Approval



UNIVERSITY OF OREGON

DATE: July 22, 2013 IRB Protocol Number: 06052013.009

TO: Camille Stewart, Principal Investigator  
Department of University Housing

RE: Protocol entitled, "Developmental Assessment in Argentina: A Comparison of  
Two Screening Instruments"

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Notice of IRB Review and Approval  
Expedited Review as per Title 45 CFR Part 46.110, 63 FR 60366, #7

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The project identified above has been reviewed by the University of Oregon Institutional Review Board (IRB) and Research Compliance Services using an expedited review procedure. This is a minimal risk study. This approval is based on the assumption that the materials, including changes/clarifications that you submitted to the IRB contain a complete and accurate description of all the ways in which human subjects are involved in your research.

For this research, the following additional determinations have been made:

- The study as described satisfies the requirements for additional protections for children involved as subjects in research under 45 CFR Part 46.404. The permission of one parent or guardian is sufficient for a child's involvement in the research.
- The UO Principal Investigator named here is approved to conduct interviews with subjects, under the direction of Nicolas Cacchierelli, Hospital Italiano, and to use data from this research project for her UO honors thesis.

This approval is given with the following standard conditions:

1. You are approved to conduct this research only during the period of approval cited below;
2. You will conduct the research according to the plans and protocol submitted (approved copy enclosed);
3. You will immediately inform Research Compliance Services of any injuries or adverse research events involving subjects;
4. You will immediately request approval from the IRB of any proposed changes in your research, and you will not initiate any changes until they have been reviewed and approved by the IRB;
5. You will only use the approved informed consent document(s) (enclosed);
6. You will give each research subject a copy of the informed consent document;
7. If your research is anticipated to continue beyond the IRB approval dates, you must submit a Continuing Review Request to the IRB approximately 60 days prior to the

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## References

- American Academy of Pediatrics Council on Children with Disabilities, Section on Behavioral Pediatrics, Bright Futures Steering Committee & Medical Home Initiatives for Children with Special Needs Project Advisory Committee. (2006). Identifying infants and young children with developmental disorders in the medical home: an algorithm for developmental surveillance and screening. *Pediatrics Journal*, 118(1), 405-420.
- Aylward GP. (2009). Developmental screening and assessment: what are we thinking? *Journal of Developmental Behavior Pediatrics*, 30(2),169–173.
- Boyle, C., Boulet, S., Schieve, L., Cohen, R., Blumberg, S., Yeargin-Allsop M., ... Kogan, M. (2011). Trends in the prevalence of developmental disabilities in US children, 1997-2008. *Pediatrics Journal*, 127(6), 1034-1042.
- Behrman, R., & Butler A. (2007). *Preterm birth: Causes, consequences and prevention*. Washington, D.C.: National Academies Press.
- Dworkin P. H. (1993) Detection of behavioral, developmental, and psychosocial problems in pediatric primary care practice. *Current Opinion Pediatrics* 5, 531–536
- Early Head Start Program. (2000). Developmental screening, assessment, and evaluation: Key elements for individualizing curricula in Early Head Start Programs. Technical Assistance Paper No. 4. HHS/ACF/ACYF/HSB/EHSNRC.
- Glascoe, F. P. (1993). Obstacles to effective developmental surveillance: errors in clinical reasoning. *Journal of Developmental and Behavioral Pediatrics*, 14(5), 344-349.
- Glascoe, F. P. (2000). Early Detection of developmental and behavioral problems. *Pediatric Review*, 21,272-279.
- Guiberson, M., & Rodríguez, B. L. (2010). Measurement properties and classification accuracy of two Spanish parent surveys of language development for preschool-age children. *American Journal Of Speech-Language Pathology*, 19(3), 225-237.
- Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, 33(1), 159–174. doi:10.2307/2529310
- Lejarraga, H., Kelmansky, D., Lejarraga, C., Charrús, G., Salamanco, G., Insúa, I. & Nunes, F. (2013). Validation of a questionnaire for the detection of children at high risk of developmental disorders. The PRUNAPE pre-screening test. *Archivos Argentinos de Pediatría*, 111(6), 476-483.
- Lejarraga, H., Kelmansky, D., Pascucci, M., & Salamanco, G. (2005). *Prueba nacional de pesquisa; PRUNAPE manual técnico*. Buenos Aires, Argentina: Fundación Hospital de Pediatría “Prof. Dr. Juan P. Garrahan”.

- Lejarraga, H., Menendez, A., Menzano, E., Guerra, L., Blancato, S., Pianelli, P., ... Larigoitía, D. (2008). PRUNAPE: investigation of psychomotor development disorders in primary care. *Archivos Argentinas de Pediatría*, 106(2), 119-125.
- Ministerio de Desarrollo Social de la Nación & United Nations Children's Fund. *Encuesta sobre condiciones de vida de niñez y adolescencia. Principales resultados*. Retrieved from [http://www.unicef.org/argentina/spanish/MICS\\_CierreJulio2013\\_BAJAWEB.pdf](http://www.unicef.org/argentina/spanish/MICS_CierreJulio2013_BAJAWEB.pdf)
- Ministerio de Salud. (2013). *Estadísticas vitales: Información básica – Año 2012*. Retrieved from <http://www.deis.gov.ar/Publicaciones/Archivos/Serie5Nro56.pdf>
- Pascucci, M. C. et al. (2002). Validación de la Prueba Nacional de Pesquisa PRUNAPE. *Archivos Argentinos de Pediatría*, 100(3), 374-385.
- Pomés, M. (2012). *Examination of the Spanish translation of a developmental screening instrument*. (Unpublished doctoral dissertation). University of Oregon, Eugene, OR.
- Rydz, D., Shevell, M.I., Majnemer, A., & Osouki, M. (2005). Developmental screening. *Journal of Child Neurology*, 20(1), 4-21.
- Rydz, D., Srour, M., Oskoui, M., Marget, N., Shiller, M., Birnbaum, R., .... Shevell, M. (2006). Screening for DD in the setting of a community pediatric clinic: A prospective assessment of parent-report questionnaires *Pediatrics*, 118, 1178-186.
- Salamanco, G., D'Anna, C., & Lejarraga, H. (2004). Tiempo requerido para la administración de una prueba de pesquisa de trastornos del desarrollo psicomotor infantil. *Archivos Argentinos de Pediatría*, 102(3), 165-169.
- Sarmiento, J. A., Squires, J., & Ponte, J. (2010). Universal developmental screening: preliminary studies in Galicia, Spain. *Early Childhood Development and Care*. 1, 1-11. doi:10.1080/03004430903458007
- Schonhaut, L., Salinas, P., Armijo, I., Schönstedt, M., Álvarez, J., & Manríquez, M. (2009). Validación de un cuestionario autoadministrado para la evaluación del desarrollo psicomotor. (*Validation of a self administered questionnaire for the evaluation of psychomotor development*.) *Revista Chilena de Pediatría*, 80(6), 513-519.
- Sociedad Argentina de Pediatría. (2002). *Guías para la supervisión de la salud de niños y adolescentes*. Buenos Aires, Argentina.
- Squires, J., Bricker, D., Twombly, E., & Potter, L. (2009). *ASQ-3 User's Guide*. Baltimore: Paul H. Brookes Publishing Co.
- World Bank. (2010). *Physicians (per 1,000 people)*. <http://data.worldbank.org/indicator/SH.MED.PHYS.ZS>

World Health Organization. (2004). *Global health burden & disease report part 3: Disease incidence, prevalence, and disability*. 28-37.